

*EVALUATION OF THE IMMEDIATE AND SUBSEQUENT EFFECTS OF  
RESPONSE INTERRUPTION AND REDIRECTION ON  
VOCAL STEREOTYPY*

BRITTANY I. SCHUMACHER AND JOHN T. RAPP

ST. CLOUD STATE UNIVERSITY

We evaluated 2 3-component multiple-schedule sequences—a response interruption and redirection (RIRD) treatment sequence and a no-interaction control sequence—using a multielement design. With this design, we were able to evaluate the immediate and subsequent effects of RIRD on 2 participants' vocal stereotypy. For both participants, RIRD produced an immediate decrease in vocal stereotypy and did not result in a subsequent increase.

*Key words:* automatic reinforcement, multiple schedule, response interruption and redirection, vocal stereotypy

Individuals diagnosed with autism spectrum disorders often exhibit motor stereotypy, vocal stereotypy, or both. Engagement in such behavior can interfere with learning opportunities and can be socially stigmatizing (Cunningham & Schreibman, 2008). Stereotypy, which is often maintained by automatic reinforcement, can be difficult to treat because the stimulation generated by the behavior cannot typically be withheld. For this reason, interventions that involve the direct application of consequences for stereotypy (e.g., response blocking or redirection) may be required. However, most of these interventions have been evaluated for treating motor stereotypy rather than vocal stereotypy (Rapp & Vollmer, 2005). Based on the need to develop interventions specific to vocal stereotypy, Ahearn, Clark, MacDonald, and Chung (2007) evaluated response interruption and redirection (RIRD) as a method for treating automatically reinforced vocal stereotypy in four children with autism. During RIRD, the therapist vocally interrupted and redirected participants' vocal

stereotypy by delivering vocal prompts in the form of questions (e.g., "What is your name?") or directives (e.g., "say ball") that required the participant to emit a vocal response. The therapist continued to deliver prompts until the participant complied with three prompts in the absence of vocal stereotypy. Ahearn et al. found that RIRD decreased vocal stereotypy for all four participants and increased appropriate vocalizing for three of four participants. These findings have been replicated in subsequent studies (e.g., Ahrens, Lerman, Kodak, Worsdell, & Keegan, 2011; Cassella, Sidener, Sidener, & Progar, 2011; Liu-Gitz & Banda, 2009; Miguel, Clark, Tereshko, & Ahearn, 2009).

Although these studies have demonstrated that RIRD can significantly decrease stereotypy during intervention, it is less clear whether stereotypy will increase after RIRD is withdrawn. For example, an individual's vocal stereotypy may remain at low levels when RIRD is in effect during instructional periods. However, it is possible that RIRD imposes deprivation of the stimulation that is generated by engaging in vocal stereotypy. Thus, when RIRD is withdrawn, the individual's vocal stereotypy may subsequently increase. Therefore, the purposes of this study were (a) to determine whether RIRD decreased immediate engagement in vocal stereotypy for two participants and (b) to evaluate whether participants'

---

This study was conducted in partial fulfillment of a Masters degree in behavior analysis by the first author.

Address correspondence to John T. Rapp, St. Cloud State University, Education Building, A 261, 720 4th Avenue South, St. Cloud, Minnesota 56301 (e-mail: jtrapp@stcloudstate.edu).

doi: 10.1901/jaba.2011.44-681

vocal stereotypy increased above no-intervention levels after RIRD was removed.

## METHOD

### *Participants and Setting*

Two children who had been diagnosed with autism and displayed vocal stereotypy participated in this study. Miranda was a 5-year-old girl with significant language delays. She responded vocally to many different instructions, including identifying body parts, making animal sounds, providing personal information, and completing phrases. She used multiple-word phrases to request items in the home. Nick was an 8-year-old boy with some language delays. He responded vocally to many different instructions, including answering “wh-?” questions about occupations, categories, and associations. Nick used complete sentences to request items. Sessions were conducted in an at-home therapy room that contained a table and two chairs.

### *Response Measurement and Interobserver Agreement*

Vocal stereotypy was defined as the emission of acontextual audible sounds or words for 2 s or longer. Observers used laptop computers to collect data on vocal stereotypy from videotaped sessions. Data were collected using continuous duration recording and were summarized as the percentage of session with vocal stereotypy. For each participant, a second observer scored 30% of the sessions. Interobserver agreement scores were calculated by partitioning each session into successive 10-s bins and comparing data collected by the primary and secondary observers on a bin-by-bin basis (see Mudford, Taylor, & Martin, 2009). For each bin, the smaller value was divided by the larger value, and the quotients from all of the bins were summed and multiplied by 100%. The mean agreement scores for Miranda and Nick were 96% (range, 87% to 99%) and 90% (range, 84% to 100%), respectively.

### *Design and Procedure*

A multielement design with an embedded three-component multiple schedule was used to evaluate the effects of RIRD on vocal stereotypy. Each participant's vocal stereotypy was evaluated during a no-interaction (NI) sequence and an RIRD sequence. Each sequence included three consecutive 10-min components, and only one sequence was conducted per day.

*No-interaction sequence.* The NI sequence consisted of three 10-min NI components. During an NI component, a therapist was present in the room but did not interact with the participant. The therapist sat in a chair or on the floor and read work materials while also operating the video camera. The NI components were signaled by the absence of materials on the walls of the room. The purposes of this sequence were (a) to demonstrate the persistence of vocal stereotypy in the absence of social consequences (see Iwata & Dozier, 2008) and (b) to serve as a baseline against which the effects of RIRD could be evaluated.

*Response interruption and redirection sequence.* The RIRD sequence consisted of three 10-min components. The first and third components were identical to the components in the NI sequence. During the second component, RIRD was in effect, and a piece of red construction paper (21 cm by 49.5 cm) was placed on the wall of the room. During the RIRD component, contingent on vocal stereotypy, the therapist presented vocal prompts that required a vocal response from the participant. For example, the therapist asked for information (e.g., “What is your name?” or “How old are you?”), identification of body parts (e.g., pointed to a body part and said “What is it?”), identification of the therapist's actions (e.g., jumped up and down and said “What am I doing?”), categories (e.g., “Name an animal” or “What is a guitar?”), job descriptions of community helpers (e.g., “What does a dentist do?”), and identification of animal sounds (e.g., “What does a cow say?”). The therapist selected

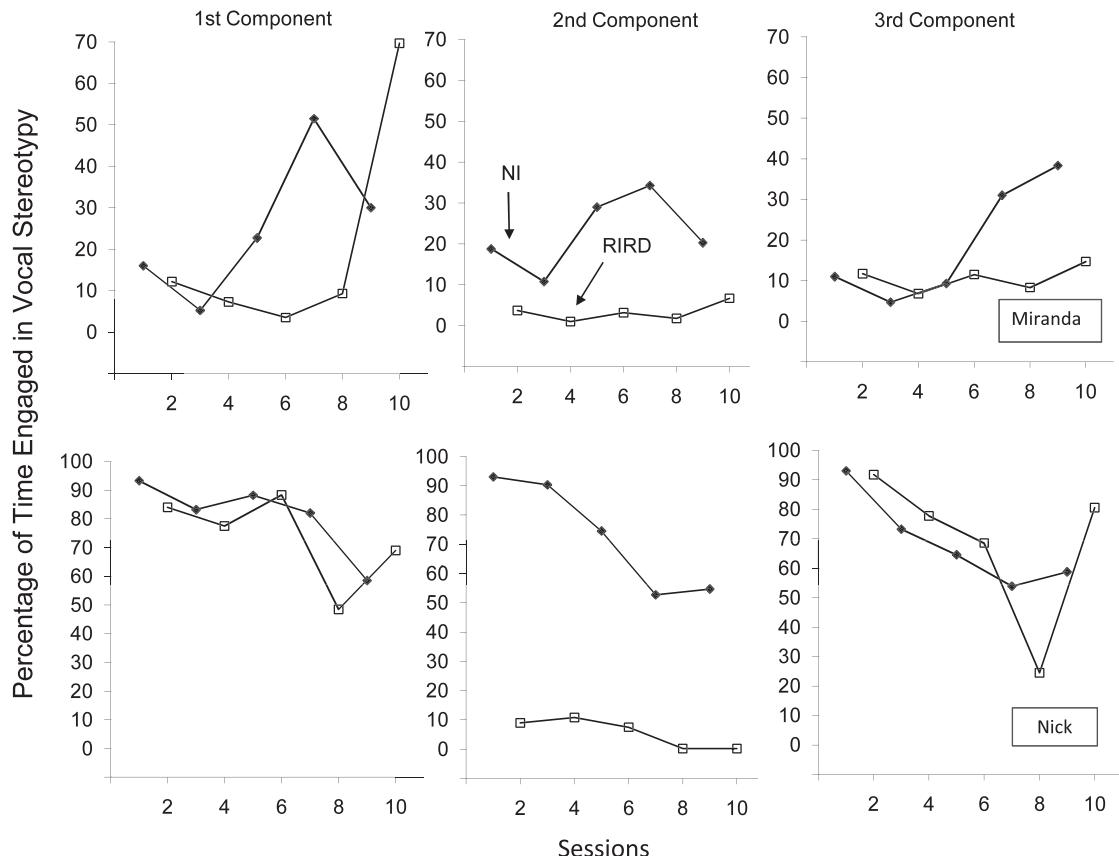


Figure 1. Percentage of time engaged in vocal stereotypy during the first, second, and third components of the no-interaction (NI) and response interruption and redirection (RIRD) sequences for Miranda (top) and Nick (bottom).

prompts from a list of 50 to 75 possible options, and these prompts were not presented in a particular sequence. The prompted vocal responses were identified from a set of educational objectives that the participant had previously acquired and had demonstrated maintained performance of at least 80% correct. If the participant did not respond or comply with the vocal prompt within 3 s, it was repeated once. In all instances, one repetition of the vocal prompt resulted in compliance. The therapist continued to deliver prompts until the participant emitted three consecutive correct responses without vocal stereotypy. Because the participants could emit vocal stereotypy during RIRD, the RIRD intervention time was not removed from session time. The purposes of the

RIRD sequence were (a) to determine whether vocal stereotypy decreased in the second component when RIRD was in effect and (b) to determine if these decreases were maintained or resulted in subsequent response increases in the third component (compared to the third component of the NI sequence or the first component of the RIRD sequence; see Lanovaz, Rapp, & Fletcher, 2010) after RIRD was removed.

## RESULTS AND DISCUSSION

Figure 1 depicts data for both participants during the first, second, and third components of the NI and RIRD sequences. Miranda's data showed that her vocal stereotypy persisted across

sessions in all three components of the NI sequence. During the first components, her vocal stereotypy occurred at moderate and increasing levels in both sequences. In the second components, vocal stereotypy remained at moderate, stable levels in the NI sequence but decreased to near-zero levels in the RIRD sequence. The results from the second components indicate that RIRD produced an immediate decrease in vocal stereotypy. In the third components, vocal stereotypy occurred at moderate levels in both sequences, with levels increasing across the last three sessions of the NI sequence. The results from the third components suggest that the removal of RIRD did not increase engagement in vocal stereotypy relative to NI. A similar outcome was evident when comparing the first and third components of the RIRD sequence. That is, Miranda's vocal stereotypy was no higher in the third component of the RIRD sequence (immediately following the removal of RIRD) than in the first component of the RIRD sequence (immediately prior to the implementation of RIRD). Together, these results showed that RIRD produced an immediate reduction in Miranda's vocal stereotypy, but its removal did not produce a subsequent increase in vocal stereotypy.

As with Miranda, Nick's vocal stereotypy persisted across sessions in all three components of the NI sequence. During the first components, levels of vocal stereotypy were decreasing and undifferentiated across sessions in both sequences. In the second components, vocal stereotypy decreased slightly across sessions in the NI sequence and decreased to zero in the RIRD sequence. In the third components, levels of vocal stereotypy were initially high and decreasing but ultimately variable in both sequences. Furthermore, levels of vocal stereotypy were similar during the first and third components of the RIRD sequence. As with Miranda, these results suggest that RIRD did not produce a subsequent increase in vocal stereotypy.

These findings replicate previous research by showing that RIRD effectively decreased vocal stereotypy (e.g., Ahearn et al., 2007; Liu-Gitz & Banda, 2009; Miguel et al., 2009). In addition, results extend the literature by showing that RIRD did not produce subsequent increases in vocal stereotypy (relative to NI) for two participants when the procedure was removed. By contrast, studies have shown that the removal of verbal reprimands and response blocking can increase subsequent engagement in stereotypy (e.g., Rapp, 2006, 2007). The clinical implication of these combined findings is that RIRD may be an effective intervention for vocal stereotypy in educational settings.

Some limitations of this study deserve comment. First, we did not provide attention for participants' appropriate vocalizations during RIRD. Although including contingent attention during RIRD may have facilitated treatment effects, we conducted RIRD alone to permit us to independently evaluate RIRD effects on participants' subsequent engagement in automatically reinforced vocal stereotypy. Second, our RIRD treatment component lasted only 10 min, which may have been too brief to impose deprivation of the stimulation generated by vocal stereotypy. Third, we did not subtract RIRD intervention time from the session time. Thus, decreases in vocal stereotypy during the second component of the RIRD sequence may have been resulted from reduced time to engage in vocal stereotypy. However, because participants could still engage in vocal stereotypy during RIRD and because RIRD was implemented only a few times per session, this alternative explanation seems unlikely. Lastly, we ended each sequence based on a fixed number of sessions rather than on stability criteria within and across test and control sequences.

Future research should establish formal guidelines for determining whether an intervention produces a subsequent increase in a problem behavior. For example, Nick's vocal stereotypy was higher in the third component

than in the first component for two sessions in the RIRD sequence compared to zero sessions in the NI sequence. However, this comparison was not necessarily meaningful because his vocal stereotypy decreased across sessions in the first and third components of the NI sequence, and the mean percentage of time he engaged in vocal stereotypy during the third components of both sequences was nearly identical. Thus, it may be useful to develop specific criteria regarding the overall level and range of behavior in the first and second components before proceeding with a postintervention analysis (i.e., implementation of the third components). In addition, criteria for obtaining stability within and across test and control sequences could be developed, allowing a more definitive interpretation of intervention effects on automatically reinforced behavior.

## REFERENCES

Ahearn, W. H., Clark, K. M., MacDonald, R. P. F., & Chung, B. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis, 40*, 263–275.

Ahrens, E. N., Lerman, D. C., Kodak, T., Worsdell, A. S., & Keegan, C. (2011). Further evaluation of response interruption and redirection as treatment for stereotypy. *Journal of Applied Behavior Analysis, 44*, 95–108.

Cassella, M. D., Sidener, T. M., Sidener, D. W., & Progar, P. R. (2011). Response interruption and redirection for vocal stereotypy in children with autism: A systematic replication. *Journal of Applied Behavior Analysis, 44*, 169–173.

Cunningham, A. B., & Schreibman, L. (2008). Stereotypy in autism: The importance of function. *Research in Autism Spectrum Disorders, 2*, 469–479.

Iwata, B. A., & Dozier, C. L. (2008). Clinical application of functional analysis methodology. *Behavior Analysis in Practice, 1*, 3–9.

Lanovaz, M. J., Rapp, J. T., & Fletcher, S. E. (2010). Expanding functional analysis of automatically reinforced behavior using a three-component multiple schedule. *European Journal of Behavior Analysis, 11*, 17–27.

Liu-Gitz, L., & Banda, D. R. (2009). A replication of the RIRD strategy to decrease vocal stereotypy in a student with autism. *Behavioral Interventions, 25*, 77–87.

Miguel, C. F., Clark, K., Tereshko, L., & Ahearn, W. H. (2009). The effects of response interruption and redirection and sertraline on vocal stereotypy. *Journal of Applied Behavior Analysis, 42*, 883–888.

Mudford, O. C., Taylor, S. A., & Martin, N. T. (2009). Continuous recording and interobserver agreement algorithms reported in the *Journal of Applied Behavior Analysis* (1995–2005). *Journal of Applied Behavior Analysis, 42*, 165–169.

Rapp, J. T. (2006). Toward an empirical method for identifying matched stimulation: A preliminary investigation. *Journal of Applied Behavior Analysis, 39*, 137–140.

Rapp, J. T. (2007). Further evaluation of methods for identifying matched stimulation. *Journal of Applied Behavior Analysis, 40*, 73–88.

Rapp, J. T., & Vollmer, T. R. (2005). Stereotypy: I. A review of behavioral assessment and treatment. *Research in Developmental Disabilities, 26*, 527–547.

Received May 13, 2010

Final acceptance December 10, 2010

Action Editor, Eileen Roscoe